What is claimed is:

1. An integrated digital control system for an automotive electrical device comprising:

switch means for controlling each portion of a vehicle, the switch means including switches;

switch monitor means for displaying switch functions and operational states of the switches input from the switch means;

switch control means for generating pulse signals corresponding to the switches operated and controlling the switch monitor means;

auxiliary control means for performing input/output control, malfunction detection, automatic control, etc. of each logic-division portion;

central control means for performing control of the auxiliary control means and all data;

instrument panel/monitor means for performing an instrument panel simulation and applications program graphic processing according to control by the central control means; and

RPM pulse generating means for providing RPM pulses to the central control means and the auxiliary control means through an RPM pulse cable.

2. The integrated digital control system of claim 1 wherein the switch means comprises panel switch means including switches in a panel configuration for the control of each portion of the vehicle; remote switch means for enabling the switches of the panel switch means to be freely positioned; and means for generating pulses according to the depressed switches.

3. The integrated digital control system of claim 2 wherein the panel switch means comprises S2 switches that are mode switches able to call the switches; S2 switches for individually operating the switches appearing on a screen of the switch monitor means; and P switches for varying a function of the switches according to the on operation of the S2 switch.

4. The integrated digital control system of claim 3 wherein the S2 switches alter the screen of the switch monitor means through a switch screen corresponding to a depressed switch, and which generates pulses according to the depressed switch.

5. The integrated digital control system of claim 3 wherein the P switches connect switches in the screen of the

switch monitor means through a single switch, and are used as automatic operational switches when operated all at once.

6. The integrated digital control system of claim 2 wherein the remote switch means comprises P increase and P reduction switches for increasing and reducing P switches in the panel switch means during operation of the P switches; S2 increase and S2 reduction switches for temporarily increasing and reducing (by as many times as they are depressed) on positions of S2 switches of the panel switch means; and check/cancel switches for performing a check using a program when the switches are automatically controlled.

7. The integrated digital control system of claim 6 wherein if there is no switch input during a predetermined delay time in an on state of the S2 switches, which are increased and decreased, the S2 increase and S2 reduction switches are automatically initialized to a characteristic S2 switch value established in the remote switch means.

8. The integrated digital control system of claim 1 wherein the switch monitor means displays operational states of switches according to control by the switch control means by illuminating switch LEDs.

9. The integrated digital control system of claim 1 wherein the switch control means comprises chattering removal units for removing chattering generated at switch contact points during switch input of panel and remote switch means; toggle state memory units for separating odd operational frequencies and even operational frequencies of the switches from output of the chattering removal units; a microcomputer for outputting control values and pulse values corresponding to the input of the switches; a plurality of switch ports connected to the toggle state memory units and which enable reading of a presently pressed switch button by the microcomputer; an interrupt generator for enabling the microcomputer to read a port generated by the switches when the switches are depressed; a self-diagnosis interface unit for performing a self-diagnosis; a monitor output port and an LED output port for outputting display control values and switch LED control values of the switch monitor means, which are output from the microcomputer through a data bus connected to each port and the microcomputer to the switch monitor means and the switch LEDs; and a pulse output unit connected to the microcomputer and which outputs pulse values corresponding to each switch input to the auxiliary control means.

10. The integrated digital control system of claim 1 wherein the switch means includes a ROM storing a systems operation program and a RAM for data processing.

11. The integrated digital control system of claim 1 wherein the auxiliary control means includes units corresponding on a 1:1 basis with logic regions of the vehicle.

12. The integrated digital control system of claim 1 wherein the auxiliary control means processes through software all electrical parts of the vehicle.

13. The integrated digital control system of claim 1 wherein the auxiliary control means comprises a variable sensor input unit to which all main variable sensors, auxiliary variable sensors, main switch sensors and auxiliary switch sensors are connected; a pulse sensor input unit to which all main pulse sensors and auxiliary pulse sensors are connected; a sensor input A/D converter for converting to digital values operational values of the variable sensors and switch sensors input to the variable sensor input unit; a pulse counter for converting to standard and digital values, pulses generated in all the pulse sensors, and counting the pulses; a switch input unit for reading all switching input; a switching pulse counter

for standardizing then converting to digital values output of the switch input unit; a self-diagnostic unit for performing a self-diagnosis to determine the presence of irregularities in the system when power to the electrical device is initially applied; a microcomputer for receiving input via a data bus from the sensor input A/D converter, the pulse counter, the switching pulse counter and the self-diagnostic unit, and which transmits corresponding control values to enable control of each element of the vehicle; an interrupt generator for enabling the microcomputer to read pulse output of the pulse counter and the switching pulse counter; a power supplier for supplying power to each part of the system; a fuse unit connected to the power supplier and which acts to protect the system; a relay/TR output unit connected to the fuse unit and which controls each element of the vehicle having a motor; an output interface unit for operating the relay/TR output unit according to control values output from the microcomputer and received via the data bus; a current voltage detector for detecting a voltage supplied to the relay/TR output unit, converting the voltage to a digital value, and inputting the digital value to the microcomputer via the data bus; an output return unit for monitoring an output of the output controller and inputting the output to the microcomputer through the data bus for use in malfunction detection; and a fuse return unit

for detecting a state of the fuse unit and inputting detection results to the microcomputer through the data bus for use in detecting malfunctions in various devices.

14. The integrated digital control system of claim 13 wherein the auxiliary control means further comprises a ROM for storing a program for controlling the system, and a RAM, which is a memory for processing data.

15. The integrated digital control system of claim 13 wherein the auxiliary control means further comprises a pulse output unit for controlling various pulse-control-type devices according to control by the microcomputer, and a communications port for transmitting various data results processed in the microcomputer to the central control means.

16. The integrated digital control system of claim 13 wherein identical sensors are used for the main sensors and auxiliary sensors to provide back-up in case one sensor malfunctions.

17. The integrated digital control system of claim 13 wherein the relay/TR output unit comprises a reference resistor connected to a battery supply and which reads a voltage drop

that flows as a load; a relay having a relay coil connected to the reference resistor through a fuse, an "a" contact point connected to a protection resistor one end of which is connected to the fuse, a "b" contact point grounded to a battery supply, a "c" contact point connected to both an output terminal, which is connected to vehicle devices, and a current detection input terminal; a diode connected to both ends of the relay coil of the relay and which absorbs a surge voltage generated by the relay coil; a first zener diode and first and second resistors for protecting the current voltage detector from excess voltage flowing to the current detection input terminal and for generating a needed voltage; a second zener diode, an anode terminal of which is grounded and a cathode terminal of which is connected to a third resistor and an interface diagnosis port to protect the output return interface from excess voltage; and a third zener diode, an anode terminal of which is grounded and a cathode terminal of which is connected between the fuse and the relay coil, and, at the same time, to a fuse diagnosis port to protect the fuse return interface from excess voltage.

18. The integrated digital control system of claim 17 wherein the reference resistor is a metallic resistor.

19. The integrated digital control system of claim 13 wherein the relay has an output of a battery + power voltage in a state where the output port is in an on state, and an output of a battery - power voltage in a state where the output port is in an off state.

20. The integrated digital control system of claim 13 wherein motors connected to the relay/TR output unit include a pulse ring for detecting rpm of the motors, and a main pulse sensor and an auxiliary pulse sensor for reading motor rpm, the pulse ring, main pulse sensor, and auxiliary pulse sensor being mounted on or adjacent to a rotational shaft of the motors.

21. The integrated digital control system of claim 20 wherein non-contact sensors are used for the main pulse sensor and the auxiliary pulse sensor.

22. The integrated digital control system of claim 1 wherein the central control means references integrated code data, permanently stores the integrated code data, and includes an operations system for controlling an applications program based in the integrated code data.

23. An integrated digital control method for an automotive electrical device comprising the steps of:

performing logic divisions of each portion of the vehicle into predetermined regions;

performing digital conversion of corresponding input/output data according to each divided region, and analyzing the input data according to region and performing integrated management into integrated code data to control the electrical device in the corresponding region;

detecting malfunctions of the electrical device in the corresponding region; and

controlling the detected malfunction in the corresponding region.

24. The method of claim 23 wherein the detection of malfunctions in the electrical device is realized through a sensor malfunction detection routine comprising the steps of:

detecting a disconnection, short, or error malfunction by referencing converted data of variable sensors or pulse sensors if a predetermined timer interrupt value is a predetermined variable sensor or pulse sensor malfunction detection execution value, and recording the malfunction; and

detecting and recording an operational frequency if the timer interrupt value is an operational frequency detection execution value.

25. The method of claim 24 wherein the detection of a sensor disconnection malfunction comprises the steps of:

comparing a sensor value with a predetermined disconnection value;

comparing a disconnection detection frequency with a predetermined disconnection determination value if the sensor value is greater than the predetermined disconnection value; and

determining that there is a sensor disconnection if the disconnection detection frequency is greater than the predetermined disconnection determination value.

26. The method of claim 24 wherein the detection of a sensor short malfunction comprises the steps of:

comparing a sensor value with a predetermined short value;

comparing a short detection frequency with a predetermined short determination value if the sensor value is greater than the predetermined short value; and

determining that there is a sensor short if the short detection frequency is greater than the predetermined short determination value.

27. The method of claim 24 wherein the detection of a sensor error malfunction comprises the steps of:

determining if sensing values of a main sensor and an auxiliary sensor are identical;

comparing an error detection frequency of a corresponding sensor with a predetermined error determination value if the sensing values of the main and auxiliary sensors are not identical; and

determining that there is an error in the corresponding sensor if the error detection frequency is greater than the predetermined error determination value.

28. The method of claim 24 wherein the detection of the operational frequency of the sensor comprises the steps of:

determining if a corresponding sensor is established as a frequency detection sensor;

determining if the corresponding sensor corresponds to an overall operation state if the corresponding sensor is established as a frequency detection sensor; and

determining an increase in the operation frequency of the corresponding sensor if the corresponding sensor corresponds to an overall operational state.

29. The method of claim 23 wherein the detection of malfunctions in the electrical device is realized through a malfunction detection routine comprising the steps of:

detecting a short or disconnection malfunction of devices connected to output ports if a timer value is a predetermined short or disconnection malfunction detection execution value of a corresponding output element, and recording the malfunction; and

detecting and recording the malfunction of the corresponding device if the timer value is the predetermined malfunction detection execution value.

30. The method of claim 29 wherein the short malfunction detection of the corresponding output element comprises the steps of:

comparing a short detection frequency of the corresponding output element with a predetermined short determination value if a current value of the corresponding output element is greater than a predetermined short value; and

determining that there is a short in the corresponding output element if the short detection frequency is greater than the short determination value.

31. The method of claim 29 wherein the disconnection malfunction detection of the corresponding output element comprises the steps of:

comparing a disconnection detection frequency of the corresponding output element with a predetermined disconnection determination value if a current value of the corresponding output element is less than a predetermined disconnection value; and

determining that there is a disconnection in the corresponding output element if the disconnection detection frequency is greater than the disconnection determination value.

32. The method of claim 23 wherein the detection of malfunctions in the electrical device is realized through a motor malfunction detection routine comprising the steps of:

detecting a position control motor malfunction if a predetermined timer interrupt value becomes a predetermined malfunction detection value of a corresponding position control motor; and

determining a malfunction in a motor rotational state of the corresponding motor if the timer interrupt value becomes the predetermined malfunction detection value of the corresponding motor.

33. The method of claim 32 wherein in the detection of a malfunction in the corresponding position control motor, a malfunction is determined to have occurred if the corresponding motor has not reached a stop position within a predetermined delay effective time.

34. The method of claim 32 wherein the detection of a malfunction in the corresponding position control motor comprises the steps of:

comparing a malfunction detection frequency of the corresponding motor with a predetermined malfunction determination value if a rotational value of the corresponding motor is less than a predetermined malfunction permission limit value; and

determining that the corresponding motor is experiencing a rotational malfunction if the malfunction detection frequency is greater than the malfunction determination value.

35. The method of claim 23 wherein the controlling of the electrical device is realized through a motor position control routine comprising the steps of:

stopping a corresponding motor if a position value of the corresponding motor is within a stop value permission range, which is determined in the case where a predetermined timer interrupt value is identical to a predetermined motor control operational value;

performing control for the reverse rotation of the corresponding motor if the position value of the motor is greater than the stop value, which is determined in the case where the position value of the corresponding motor is not within the stop value permission range; and

performing control for the forward rotation of the corresponding motor if the position value of the corresponding motor is smaller than the stop value.

36. The method of claim 23 wherein the malfunction detection of the electrical device is realized through rotational state malfunction detection of devices rotating by engine torque comprising the steps of:

comparing a malfunction detection frequency with a predetermined malfunction determination value if a rotational

ratio is greater than a predetermined permission limit value; and

determining that there is a malfunction in a rotational state of a corresponding rotating element if the malfunction detection frequency is greater than the predetermined permission limit value.

37. The method of claim 23 wherein the malfunction detection and control of the electrical device is realized through battery connection defect detection and control comprising the steps of:

comparing a battery connection defect detection frequency with a predetermined battery connection defect detection determination value if engine RPM is  greater than a standard value and a battery B voltage is greater than an M voltage; and

recording a battery connection defect and converting to a low voltage charge is the battery connection defect detection frequency is greater than the battery connection defect detection determination value.

38. The method of claim 23 wherein the malfunction detection and control of the electrical device is realized through generator output wire connection defect detection and control comprising the steps of:

comparing a generator output wire connection defect detection frequency with a predetermined generator output wire connection defect determination value if engine RPM and a generator N voltage value are greater than predetermined values and if a battery voltage is less than a predetermined value; and

discontinuing generator charging and recording a generator output wire connection defect if the generator output wire connection defect detection frequency is greater than the determination value.

39. The method of claim 23 wherein the detection of malfunctions in the electrical device is realized through generator malfunction detection comprising the steps of:

comparing a generator malfunction detection frequency with a predetermined determination value for detecting a generator malfunction if engine RPM and a generator F voltage are greater than predetermined values and if a battery voltage is less than a predetermined value; and

recording a generator malfunction detecting a generator malfunction if the generator malfunction detection frequency is greater than the determination value.

40. The method of claim 23 wherein the detection of malfunctions in the electrical device is realized through generator N wire malfunction detection comprising the steps of:

determining there is a generator N wire malfunction if engine RPM is greater than a predetermined value, a generator N voltage is less than a predetermined value, and a battery voltage is normal, then increasing a generator N wire malfunction detection frequency; and

recording an N wire malfunction and detecting a generator N wire malfunction if the generator N wire malfunction detection frequency is greater than a generator N wire malfunction determination value.

41. The method of claim 23 wherein the malfunction detection and control of the electrical device is realized through generator N danger voltage detection and control comprising the steps of:

comparing an N danger voltage detection frequency with a predetermined generator N danger voltage determination value if a generator N voltage is greater than a danger voltage standard value; and

cutting off a generator F power and recording the discontinuing of the generator F power if the N danger voltage

detection frequency is greater than the generator N danger voltage determination value.

42. The method of claim 23 wherein the malfunction detection and control of the electrical device is realized through battery terminal defect detection and control comprising the steps of:

comparing a battery terminal defect detection frequency with a predetermined generator terminal defect determination value if an RPM is greater than a predetermined value and a generator M voltage is less than a predetermined value; and

converting to low voltage charging if the battery terminal defect detection frequency is greater than the generator terminal defect determination value, the recording the battery terminal defect.

43. The method of claim 23 wherein the malfunction detection and control of the electrical device is realized through excess voltage detection and control comprising the steps of:

comparing an excess voltage detection frequency with an excess voltage determination value if a battery voltage is greater than a predetermined excess voltage value; and

recording an excess voltage detection and a voltage regulator malfunction, and converting to an auxiliary voltage regulator, if the excess voltage detection frequency is greater than the determination value.

44. The method of claim 23 wherein the malfunction detection of the electrical device is realized through voltage regulator malfunction detection comprising the steps of:

comparing a voltage regulator malfunction detection frequency with a predetermined voltage regulator malfunction determination value if engine RPM is greater than a predetermined value and if a battery voltage is less than a predetermined generator F voltage; and

recording a voltage regulator malfunction if the voltage regulator malfunction detection frequency is greater than the predetermined voltage regulator malfunction determination value.

45. The method of claim 23 wherein the malfunction detection and control of the electrical device is realized through danger voltage detection and control comprising the steps of:

comparing a danger voltage detection frequency with a determination value for determining a danger voltage if a

battery voltage is greater than a predetermined danger voltage value; and

cutting off a generator F power and recording a danger voltage detection if the danger voltage detection frequency is greater than the determination value.

46. The method of claim 23 wherein the control of the electrical device is realized by, where there is switch pulse input, counting switching pulses during a switching pulse input effective interval and a corresponding switch input interrupt is generated and controlled.

47. The method of claim 23 wherein the control of the electrical device is realized through a switch input processing procedure comprising the steps of:

(a) generating a pulse corresponding to a depressed switch when a panel switch is depressed for control of the electrical device, and refreshing a screen of a switch monitor means;

(b) increasing or reducing a temporary S2 switch value according to a value of an S2 temporary change effective timer during input of an S2 increase or decrease switch of a remote switch means for controlling the electrical device, then recharging the S2 temporary change effective timer and

outputting a corresponding pulse to refresh the screen of the switch monitor means; and

(c) outputting an increased or decreased pulse from a P increase or decrease switch on position to a present S2 value according to the S2 temporary change effective timer value during input of the P increase or decrease switch of a remote switch means for controlling the electrical device, and refreshing the screen of the switch monitor means.

48. The method of claim 47 wherein in step (b), during the S2 increase switch input, if the S2 temporary change effective timer is 0, an S2 switch position value is converted to a standard S2 switch value and the S2 temporary change effective timer is recharged, and if not 0, the temporary S2 switch value is increased, the S2 temporary change effective timer is recharged, and the corresponding pulse is output to refresh the screen of the switch monitor means.

49. The method of claim 48 wherein if the S2 temporary change effective timer is not 0, only when a present S2 temporary change switch position value is not a final switch value is the temporary S2 switch value increased.

50. The method of claim 47 wherein in step (b), during the S2 decrease switch input, if the S2 temporary change effective timer is 0, the screen of the switch monitor means is refreshed, and if not 0, the temporary S2 switch value is decreased, the S2 temporary change effective timer is recharged, and the corresponding pulse is output to refresh the screen of the switch monitor means.

51. The method of claim 50 wherein if the S2 temporary change effective timer is not 0, only when a present S2 temporary change switch position value is not a standard S2 switch value is the temporary S2 switch value decreased.

52. The method of claim 47 wherein in step (c), during the P increase or decrease switch input, if the S2 temporary change effective timer is 0, an S2 position pointer is renewed to a predetermined characteristic S2 position pointer position, an increased or decreased position pulse from a P increase or decrease switch on position to a present S2 value, and a pulse is generated, and if the S2 temporary change effective timer is not 0, the S2 temporary change effective timer is recharged, an increased or reduced position pulse from the P increase or decrease switch on position is added to a present temporary S2

value, and a corresponding pulse is output to refresh the screen of the switch monitor means.

53. The method of claim 52 wherein if the present P increase switch on position is not a final switch during P increase switch input, increase is performed and a corresponding control code is output.

54. The method of claim 52 wherein if the present P decrease switch on position is not an initial switch during P decrease switch input, decrease is performed and a corresponding control code is output.

55. An integrated digital control method for an automotive electrical device comprising the steps of:

digitally processing input data separately according to divided region of the vehicle;

analyzing the digitally processed input data according to region and performing integrated control;

digitally controlling electrical devices according to region, and performing the detection of malfunctions generated in the electrical devices and controlling the malfunctions; and

performing the intelligent processing of electrical parts.

56. The method of claim 55 wherein the intelligent processing of electrical parts is realized through an electrical part control-type program.

57. The method of claim 55 wherein the intelligent processing of electrical parts is realized through a speed control controller routine comprising the steps of:

determining if a present speed is greater than a predetermined value if a timer value is a predetermined speed control execution value;

re-establishing a speed control motor at a stop position if the present speed is greater than the predetermined speed control execution value; and

re-establishing the speed control motor at an acceleration position if the present speed is not greater than the predetermined speed control execution value.

58. An integrated digital control method for an automotive electrical device comprising the steps of:

performing logic divisions of each portion of the vehicle into predetermined regions;

digitally controlling input/output data of the divided regions according to a corresponding region; and

performing integrated control of the data of a corresponding region.

59. The method of claim 58 wherein in the step of performing logic divisions of each portion, a predetermined switch input is transmitted to all divided regions.

60. The method of claim 58 wherein digital control of input/output data includes a plurality of control routines included identically in each logic division.

61. The method of claim 60 wherein the plurality of control routines includes the detection of malfunctions in the electrical device and control of the detected malfunctions.

62. The method of claim 61 wherein the control of detection of malfunctions in the electrical device is realized through a sensor malfunction detection routine comprising the steps of:

detecting a disconnection, short, or error malfunction by referencing converted data of variable sensors or pulse sensors if a predetermined timer interrupt value is a predetermined variable sensor or pulse sensor malfunction detection execution value, and recording the malfunction; and

detecting and recording an operational frequency if the timer interrupt value is an operational frequency detection execution value.

63. The method of claim 61 wherein the detection of malfunctions in the electrical device is realized through a malfunction detection routine comprising the steps of:

detecting a short or disconnection malfunction of devices connected to output ports if a timer value is a predetermined short or disconnection malfunction detection execution value of a corresponding output element, and recording the malfunction; and

detecting and recording the malfunction of the corresponding device if the timer value is the predetermined malfunction detection execution value.

64. The method of claim 61 wherein the detection of malfunctions in the electrical device is realized through a motor malfunction detection routine comprising the steps of:

detecting a position control motor malfunction if a predetermined timer interrupt value becomes a predetermined malfunction detection value of a corresponding position control motor; and

determining a malfunction in a motor rotational state of the corresponding motor if the timer interrupt value becomes the predetermined malfunction detection value of the corresponding motor.

65. The method of claim 64 wherein in the detection of a malfunction in the corresponding position control motor, a malfunction is determined to have occurred if the corresponding motor has not reached a stop position within a predetermined delay effective time.

66. The method of claim 64 wherein the detection of a malfunction in the motor rotational state of the corresponding motor comprises the steps of:

comparing a malfunction detection frequency of the corresponding motor with a predetermined malfunction determination value if a rotational value of the corresponding motor is less than a predetermined malfunction permission limit value; and

determining that the corresponding motor is experiencing a rotational malfunction if the malfunction detection frequency is greater than the malfunction determination value.

67. The method of claim 60 wherein the control routine is a routine in which electrical parts are intelligently processed.